

Concept Review Cards

AP Biology Exam Review

STRUCTURE:

FUNCTION:

Concept

KEY TERMS/CONCEPTS:

EXAMPLES:

Review Session #1

BIG IDEA 1: EVOLUTION

EQUATION:

$$p + q = 1$$

$$p^2 + 2pq + q^2 = 1$$

p = dom. allele

q = rec. allele

p^2 = hom. dom. genotype (AA)

$2pq$ = hetero. geno. (Aa)

q^2 = hom. rec. geno. (aa)

KEY TERMS/CONCEPTS:

- 5 Conditions?

1. large pop. (no drift)

2. random mating

- Genetic Drift

(bottleneck, founder effect)

3. no selection

4. no migration

5. no mutation

Hardy-Weinberg Equilibrium

Purpose:

not possible!
- ideal

no evolution happening!

KEY TERMS/CONCEPTS:

- Variation
- Heredity
- Reproductive Fitness

Modes of Selection:

- Disruptive -
- Directional -
- Stabilizing -

Natural Selection

Evidence for Evolution:

Contrast Against :
Lamarck – Theory of
acquired characteristics

ALLOPATRIC :

- Physical barrier separates population into 2 populations → 2 species

- Examples:

Adaptive Radiation
(Darwin's Finches)

SYMPATRIC :

- No physical barrier; same habitat. Organisms selectively breed to create 2 species over time.

- Examples:

- Polyploidy (plants)
- Chromosomal Rearrangements

Speciation

Tempos of Speciation:

- Gradualism
- Punctuated Equilibrium

How does speciation occur?

- Prezygotic Barriers
(Isolation: Geographic, behavioral, habitat, temporal, mechanical)
- Postzygotic Barriers
 - (developmental inviability, sterility)

Review Session #2

BIG IDEA 2 : FREE ENERGY

STRUCTURE:

- 2 hydrogens, 1 oxygen
- covalent bond
- polar molecule

FUNCTION:

- excellent solvent
- turgor pressure in plant cells
-

Water

KEY TERMS/CONCEPTS:

- Solvent
- high heat capacity
- solid is less dense than liquid form
- strong cohesion
- high surface tension
- strong adhesion

EXAMPLES:

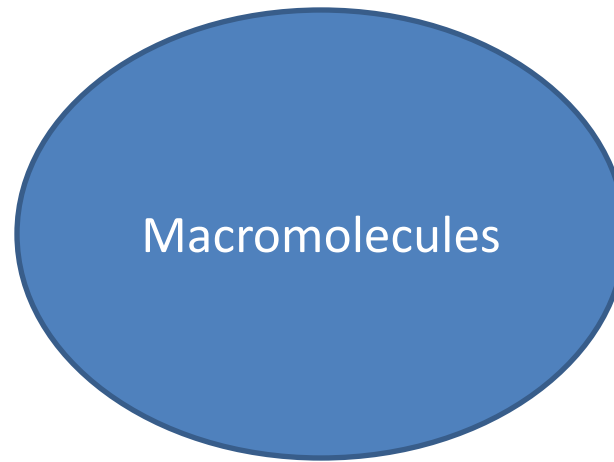
- ice floats
- water spider resting on top of water
- capillary action in plants (xylem)

Carbohydrates:

- monosaccharides (glucose)
- Disaccharides (2)
- polysaccharides (3 or more)
- energy and energy storage
- broken down during respiration ; converted into ATP
- Structural carbohydrates
- cell-to-cell recognition

Nucleic Acids:

- nucleotides (sugar, phosphate, base)
- double helix
- DNA: A, T, C, G
- RNA: A, U, C, G
- information storage
- directs protein synthesis (transcription and translation)



Dehydration Synthesis – building polymers

Hydrolysis – breaking down polymers

Functional Groups:

Amino + Carboxyl = amino acid

Methyl = affects gene expression

Sulfhydryl = in proteins

Phosphate = nucleic acids

Carbonyl

Hydroxyl = alcohols, polar, soluble in water

Lipids

- glycerol, 3 fatty acid chains
- 5 rings (steroids, cholesterol)
- energy storage
- structure (cell membrane)
- hormones (signal molecules)

Proteins:

- amino acids
- peptide bonds
- 1 = a.a. sequence
- 2=alpha helix + beta sheet
- 3=folding 3D shape
- 4=2 subunits bonding
- structure
- transport
- defense
- enzymes (catalyst)

TYPES:

- Prokaryote (bacteria)
- Eukaryote (plant, animal, fungus, protist)

Description:

- prokaryotes** - circular DNA, ribosomes, no nucleus or organelles, cell wall
- Animals** – lysosomes, centrioles
- plants** – cell wall, chloroplasts, central vacuole

Cells

KEY TERMS/CONCEPTS:

- organelles: nucleus, ribosomes, ER, Golgi, vesicles, mitochondria, chloroplasts, lysosomes, centrioles, vacuoles
- flagella, cilia (movement)
- cytoskeleton (microtubules, microfilaments)

STRUCTURE:

- Proteins embedded in a phospholipid bilayer

FUNCTION:

- selectively permeable
- control passage of materials in and out of cell
- regulate solute concentration inside cell

Cell Membrane

KEY TERMS/CONCEPTS:

- diffusion
- osmosis
- active transport
- hypertonic, hyptonic, isotonic
- Plasmolysis (plants)
- Exocytosis, endocytosis, phagocytosis, pinocytosis

EXAMPLES:

- Ion channel
- channel protein vs. carrier proteins
- Na – K pump
- aquaporin

Overview:

- Equation
- glycolysis = all organisms (cytoplasm)
- chemiosmosis = eukaryotes only (mitochondria)
- Purpose: conversion of food into ATP

Glycolysis:

- Glucose → pyruvate
- Cytoplasm
- Products : 2 ATP, 2 NADH, 2 Pyruvate

Cell Respiration

Kreb's Cycle (Citric Acid):

- pyruvate → acetyl CoA → Kreb's Cycle
- Matrix of Mitochondria
- Products: 1 ATP, 3 NADH, 1 FADH, CO₂ (byproduct)
- Purpose: make electron donators for the ETC (NADH and FADH)

ETC:

- chemiosmosis, oxidative phosphorylation
- NADH and FADH donate electrons → produces H⁺ gradient
- Oxygen is electron acceptor
- 36 ATP
- mitochondria membrane

Overview:

- Equation
- 2 parts: Light Reactions and Dark Reactions (Calvin-Cycle)
- location – chloroplast of plant cells
- chemiosmosis
- autotrophs

FUNCTION:

- harvest the light energy and create food (glucose) for the plant
- converts light energy into ATP and NADPH and then uses that energy to create food.

Photosynthesis

Light- Dependent Reactions:

- thylakoid membrane
- Photosystem II (P680)
- Photosystem I (P700)
- accessory pigments – pass e^- to rxn center.
- Electrons donated by water
- creates ATP (chemiosmosis) and NADPH

Light-Independent Reactions:

- Stroma
- carbon fixation
- converts carbon dioxide into glucose
- Rubisco – important enzyme in carbon fixation
- uses ATP and NADPH to convert CO_2 into glucose

STRUCTURE:

- Nonspecific defense (innate) vs. Specific (acquired)
- Humoral Response (B-cell)
- Cell –Mediated Response (T-cells)

KEY TERMS/CONCEPTS:

- Antigen
- Antibody
- Cytokines
- Helper T-Cell
- Cytotoxic T-cell (Killer T-cell)
- Inflammatory Response
- MHC Proteins
- APC (Antigen Presenting Cell)
- Macrophage
- Perforin and Granzymes
- Cell Lysis

Immune System

FUNCTION:

- Defense against foreign or self attack
- Cell Communication
 - Cytokines (cell signaling)

Review Session #3

BIG IDEA 3 – INFORMATION

STRUCTURE:

- Functional unit – neuron
- Synapse (connecting 2 neurons)
- Parts of Brain
- Muscle Structure (lays of actin and myosin)

Nervous System

FUNCTION:

- Transmit signals between cells (neuron)
- Relay information between brain and muscle
- Cell Communication:
 - Occurs at Synapse

KEY TERMS/CONCEPTS:

- Resting Potential vs. Action Potential
- Sodium channels
- Potassium Channels
- Sodium/Potassium Pump
- Neurotransmitters
- Actin and Myosin
- Reflex Arc
- ANS – Parasympathetic vs. Sympathetic Response
- CNS vs. PNS

Muscle Contraction:

-How is this related to the Nervous System? Motor neuron signals contraction by Releasing Ca^{2+} ions

-Sarcomere – Contractile Unit

How is contraction regulated?
Tropomyosin and Ca^{2+} ions

STRUCTURE:

- Endocrine Glands with hormones
- Target Cells
- Types of hormones (lipid vs. protein)

Endocrine System

KEY TERMS/CONCEPTS:

- Signal Transduction
- Reception, Transduction, Response
- Protein Hormones (hydrophilic) vs. Lipid Hormones (hydrophobic)
- Hypothalamus and pituitary, relationship
- tropic hormone vs. nontropic hormone
- **NEGATIVE FEEDBACK**

FUNCTION:

- Long-term response
- Cell Communication
 - Endocrine signaling (through the blood)

EXAMPLES:

- Pathways to know:
 - Insulin vs. Glucagon
 - PTH and calcitonin

Overview:

- DNA → RNA → Protein
(central dogma)
- 2 major processes:
transcription, translation

Function:

- Create new proteins for
use inside the cell

Details:

- Transcription (nucleus) –
creates RNA using RNA
polymerase
- RNA Processing
(nucleus) – introns,
exons; 5' cap and poly-A
tail; creates mRNA
- Translation
(cytoplasm/ribosome) -
mRNA is read and protein
is made, tRNA carries
amino acids to ribosome
to build protein

Protein Synthesis (Gene Expression)

Key Words:

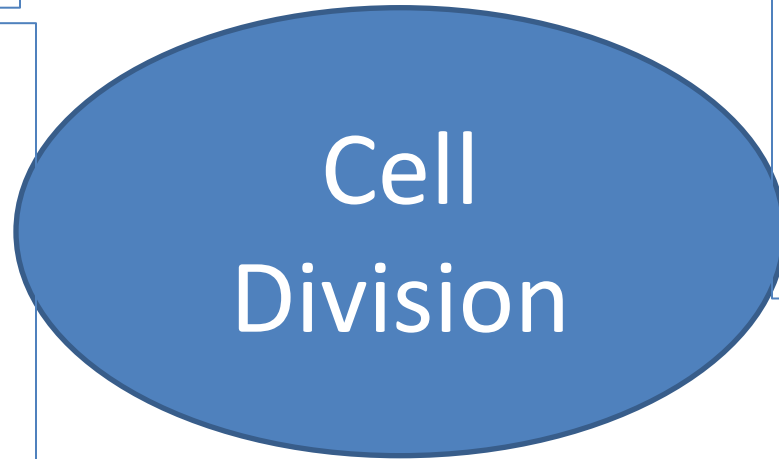
- mRNA, codon
- tRNA, anticodon
- ribosome = small RNA
subunit, large RNA subunit
- initiation, elongation,
termination

TYPES:

- Mitosis (eukaryotes for growth/repair)
- Meiosis (eukaryotes for sexual reproduction & genetic diversity)
- Binary Fission (prokaryotes – bacteria)

KEY TERMS/CONCEPTS:

- interphase (G1, S, G2)
- PMAT
- meiosis contains 2 divisions – halving the chromosome # → haploid cells
- homologous chromosomes (meiosis)
- haploid vs. diploid
- crossing over (synapse)
- karyotype
- cytokinesis
- cleavage furrow, cell plate



FUNCTION:

- produce new somatic cells (body cells – diploid)
- produce new gametes (sex cells – haploid)
- genetic variation and recombination (meiosis only)
- Binary Fission – reproduction for prokaryotes (simple reproduction)

Review Session #4

BIG IDEA 4 – SYSTEMS

STRUCTURE:

- Protein – 4 levels
- binds to substrate
- active site - groove where they bind together.

FUNCTION:

- speeds up chemical rxns by lowering activation energy
- Graph (see picture)

KEY TERMS/CONCEPTS:

- Factors affecting reactions: pH, temp, inhibitors
 - Competitive inhibitors – bind to active site, blocking substrate
 - Noncompetitive inhibitors – bind to an allosteric site → changes shape of enzyme inhibiting function

Enzymes

pH = denature = change shape

↓ temp = ↓ rxn
↑ temp = ↑ rxn until it denatures

EXAMPLES:

ase

- amylase (breaks down starch)
- catalase (breaks down hydrogen peroxide)
- DNA polymerase/RNA polymerase – builds a polymer (DNA or RNA)

Bryophytes (mosses)
-gametophyte dominant
-seedless
-nonvascular (no xylem, phloem)
-must be small
-sperm transported by water

gametophyte = n haploid

sporophyte = $2n$ diploid

Seedless Vascular (ferns):
-sporophyte dominant
-seedless (uses spores)
-vascular system (xylem and phloem)
-free-living gametophyte

* origin of plants = green algae (protist)

Plant Diversity

Gymnosperm (conifers):
-pollen
-naked seeds
-vascular
-dominant sporophyte
-Reduced dependent gametophyte

Angiosperms (flowering):
-pollen
-flowers, fruit
-seeds
-dominant sporophyte
-reduced dependent gametophyte
-monocot and dicot

cot = cotyledon
1st leaf

1
2

STRUCTURE:

- roots + shoots (organ systems)
- 3 types of tissue: ground, dermal, vascular
- xylem, phloem (vascular tissue) → H_2O ↓ sugar
- epidermis, cuticle (dermal)
- ground (storage)

GROWTH:

- lateral meristem (secondary growth) → **girth/widen**
- apical meristem (primary growth) → **roots shoots vertical growth**

Process:

- How do stomata open and close?
- How do plants obtain minerals? **roots + H_2O**

- * How do plants obtain water? **transpiration**
- How do plants move sugar? **source and sink**

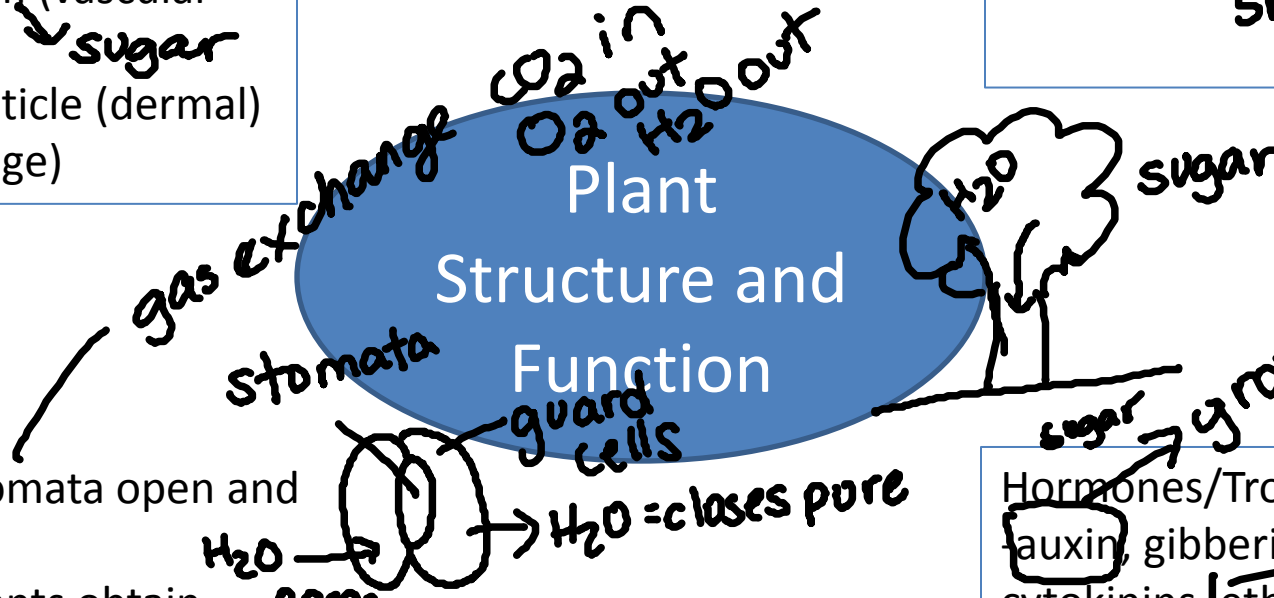
TACT theory

short day vs long day

Hormones/Tropisms:
-auxin, gibberillins, cytokinins, ethylene, abscisic acid

-phototropism, -grow light
-gravitropism, -grow gravity
-thigmotropism, -grow contact
-photoperiodism
↓ amount of light

fruit ripening



Key Equations:

$$\frac{dN}{dt} = r_{max}N - \text{exponential (J)}$$

$$\frac{dN}{dt} = r_{max}N \left(\frac{K - N}{K} \right) - \text{logistic (S)}$$

K = carrying capacity
 N = pop. size
 r_{max} = growth rate

Population Ecology

KEY TERMS/CONCEPTS:

- Dispersion Patterns
 - Random, Clumped, Uniform
- Carrying Capacity
- Survivorship Curves
 - (Type I, II, III) ^{mortality rate}
- Reproductive Strategies
 - R-strategist
 - K-strategist
- Density-Independent Limiting Factor ^{weather, disease}
- Density-Dependent Limiting Factor ^{food, H₂O, predation, space, sunlight, O₂}



KEY TERMS/CONCEPTS:

- Keystone Species
- Dominant Species
- Intraspecific Interaction
- Interspecific Interaction
- Defense Mechanisms
(mullerian, batesian, cryptic, aposematic)

- within 1 species
- among different

→ warning color
→ Camouflage

- Richness + Species Diversity
- Symbiosis
(mutualism, commensalism, parasitism)

+ / +
+ / 0
+ / -

- Succession (primary and Secondary)

1st time grow (pioneer species)
2nd time grow

Climax community

- Niche
- Fundamental vs.

→ ubiquity → entire range
→ realized → small range

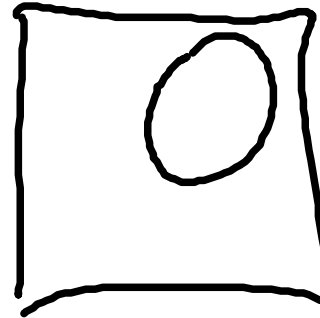
Types of Competition:

- Exploitative
- Apparent
- Interference

Solutions to Competition:

- Resource partitioning
- Character displacement

Community Ecology



KEY TERMS:

Nutrient Cycles:

Nitrogen –

Phosphorus –

Carbon –

Water

-Gross Primary
Productivity

-Net Primary
Productivity

-Eutrophication

-Characteristics of
Biomes

CONCEPTS:

1. First Law of
Thermodynamics
2. Second Law of
Thermodynamics

Energy Transformation

Ecosystem Ecology